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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
09/070,908	05/04/98	SAKAMA M	0756-1799

IM22/0215

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EXAMINER
PADGETT, M

ART UNIT	PAPER NUMBER
1762	20

DATE MAILED: 02/15/01

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No.	Applicant(s)
09/070908	Sakama
Examiner	**Group Art Unit**
M. Padgett	1762

—The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address—

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication .
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).

Status

☒ Responsive to communication(s) filed on 12/30/02.

☐ This action is **FINAL.**

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 1 1; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 23-29 + 31 - 118 is/are pending in the application.

Of the above claim(s) _____ is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 23-29 + 31-118 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement.

Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 11 9(a)-(d).

☐ All ☐ Some* ☐ None of the CERTIFIED copies of the priority documents have been

☐ received.

☐ received in Application No. (Series Code/Serial Number) _____.

☐ received in this national stage application from the International Bureau (PCT Rule 1 7.2(a)).

*Certified copies not received: _____.

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

1. A request for continued examination under 37 CAR 1.114, including the fee set forth in 37 CAR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CAR 1.114, and the fee set forth in 37 CAR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CAR 1.114. Applicant's submission filed on September 29, 2000 and October 30, 2000 has been entered.

2. Claims 23-29, 31-50 and 58-118 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claims 23-29, 58, 64, 70, 76, 82, 87, 92 and 98, "supplying... at a same flow rate with supplying said hydrogen gas" is non-idiomatic English. Would substituting --as-- for "with" provide applicant's intended meaning? Also, in claims 23-29 and 76, second recitation of "amorphous silicon" should use an article to show its antecedent basis.

In claims 25, "radio frequency energy" is introduced on both lines 3 and 6, hence the second occurrences needs either clear differentiation or an article showing antecedent basis, in order to not be vague and indefinite. Also see claim 27, lines 3 and 6; claim 29, lines 6 and 9; claim 64, lines 6 and 8; claim 76, lines 6 and 9; claim 87, lines 6 and 9 for analogous problems, with claim 98 having similar problems in lines 10, 13 and 16, complicated by insufficiently differential terms (i.e., appropriate use of first and second, or the like are needed).

In claim 31-37, "a crystallized semi conductor film" has no clear relationship to any thing in the preceding process(es), since "a" shows no antecedent basis, and the thin film transistor has no connection to any steps.

In claims 92 and 98 "radio frequency discharge" appears to lack proper differentiation (use of first and second) and appropriate use of articles showing antecedent basis, hence making the claims vague and indefinite.

Both claims 92 and 98 contain contradicting limitation, because as written the insulting layer is required to be deposited in exactly the same place, i.e., on the insulating substrate, as the semiconductor layer. As it is impossible for both layers to occupy the same space, these claims are vague and indefinite. Note even if one assumes the intent is for one layer to be deposited on another, there are NO temporal limitation in the claims to require any order of steps being preformed for layer deposition.

Claims 58, 64, 70, 76, 82, 87, 92 and 98 have preambles that are not commensurate in scope with the claimed steps, especially the most generic claimed ones that never deposit any particular material. For example, the preamble of claim 58 lists three different films or layers, but the steps deposit the gate insulating film on an insulating substrate, making the relationship between the preamble and the body of the claim unclear. In claims, such as 82 and 87 as written, an under film on an insulating substrate has absolutely nothing to do with the layers discussed in the preamble.

In claims 107 and 108 "said hydrogen gas" lacks any antecedent basis, since the independent claims 26 and 27 are directed to "discharge gas".

3. Claims 23-29 and 31-103 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Applicant's claims have added more new matter and remain replete with new matter. The newest batch of New Matter is found in claims 60-62, 66-68, 70-73, 78-79, 83-85, 88-90, 94-95, 100-101, where applicant has changed the claims from what is disclosed in the original specification, i.e., deposited of silicon oxide film (p.25); or use of hydrogen gas (p. 11, 14, 17-19, etc), used by its self with no disclose that it maybe mixed with other gases, i.e., NO support for "comprising"; or use of silane gas (p. 11, 14-15, 17-20, etc.) also with no disclosure of mixing the silane with any other gas or that the gas used can contain or comprise other gases. Therefore, the use of "comprising" in these claims also is New Matter.

Applicant's apparent contention that since semiconductor films and ∝-Si are taught (i.e., films containing only amorphous Si), that applicants are entitled to any amorphous film as long as it contains some Si, is not convincing. No support for either "amorphous film comprising silicon" or "a semiconductor film comprising amorphous silicon" was found. Simply reordering the words as in previous responses, did not change the meaning nor fix the problem. There are statements such as pg. 1, line 5 directed to generic thin film deposition, however, no silicon or

carbon films that may contain significant other constituents, i.e. are "comprising" Si or C, were found. Reference to amorphus silicon films is found throughout the specification, with page 7 also mentioning microcrystalline Si or crystalline silicon, but no support for "....comprising..." which is open language, significantly broader in scope than the original disclosure of the specification. The addition of semiconductor does narrow the possible meanings, but does not eliminate the unsupported breath, so these broader than disclosed limitations are New Matter. Applicant's cite page 11-12 alleging support, however NO support for their "comprising" language was found where cited.

In the claims, such as 25, 27 and 29, etc., where applicant's use RF energy ambiguously, it is not necessarily clear that they require the film deposition to be caused by plasma or RF discharge, as use of RF energy does NOT necessitate that any plasma formation or discharge actually take place unless the antecedent basis is clear, since radio frequency energy may be used to power heaters, etc. The specification, specifically, from the first sentence to the end, requires that the claimed deposition be via RF plasma discharge, hence this ambiguous broadening of scope might also be New Matter.

In claims 28-29, by deleting "in a multilayer" applicant's have broadened these claims without any clear support for the new possible options in these claims. It is unclear or unspecified how these films are different, or where they are deposited. These claims could read on as assembly line process, where the different films are a series of films all deposited on

different substrates, or could read on the previously claimed multilayer. This broader scope is NEW MATTER.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 23-29, 45-59, 61-65, 67-82, 84-87, 89-104, 106-110, and 113-118 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al.

Claims 60, 66, 83 and 88 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. alone as applied above, or further in view of Mei, or Kaschmitter et al, or Yamuzaki et al.

Kozuka teaches deposition of multiple layer non-monocrystalline semiconductor devices using both single and multi chamber process, exemplified by deposition of amorphous silicon TFT (thin film transistors), by forming successive layers in a manner such that a plasma atmosphere is constantly maintained from the start until the end of the film formation process, in order to protect the interfaces from damage by initial stages of plasma formation and from contamination (Abstract) as is typically found in discontinuous plasma processes (col. 2, line 57-col. 3, line 7). In col. 4, lines 38-49, Kozuka particularly teach that "since the plasma is continuously generated, the start and end of film formation can be achieved by changing the raw material gas. During film formation, therefore, the raw material gas is preferably used, not singly but as a mixture with a

diluting gas" exemplified by H_2 which differs from the present claims, except that applicant's have now included mixture of unspecified materials with their hydrogen and silane gases, which means use of diluents now reads on claim language. Kozuka further teach "With the use of such mixed gas, when the supply of the raw material gas is terminated after the completion of film formation, the discharge is maintained by the diluting gas so that the fluctuation in plasma can be suppressed..."

Also, Embodiment 1 (col. 5, lines 57-68+) indicates a process of keeping the pressure the same for the deposition and H-plasmas. "The diluting gas can be hydrogen, argon or helium..." (col. 4). Embodiments 2 (col. 6, line 55-col. 9, line 12) and 3 (col. 9, line 15-col. 10, line 22), form plasma deposited amorphous Si TFT films using silane gas and H_2 as a diluent, with the first deposition being plasma deposited Si_3N_4 insulating film, followed by films that read on claimed deposits. Reactant gas (SiH_4) flow is stopped in each plasma chamber and the dilettante gas plasma continues in that chamber before transfer to the next chamber, where the dilettante gas plasma is present before reactive gas starts to flow into the chamber.

Kozuka differs from applicant's claims by explicitly using H_2 dilettante gas during both deposition and non-deposition plasmas in their examples; and by stating a preference for the dilettante gas (H_2 or Ar or He) to be mixed with the reactant gas; and not teaching the same flow rates for gas during and before/after the deposition; while applicant's only explicitly use hydrogen gas or "discharge gas", which is equivalent to Kozuka's dilettante gas (note use of comprising muddies this distinction) during their non-deposition plasma, either before or after the amorphous

silicon containing deposition and teach all flow rates are the same, possibly 100 sccm. From col. 4, line 50-62, it appears that the main reason the dilettante gas is used with the reactant gas is so that only one gas flow needs to be turned off, and thus avoids problems if one's flow control equipment has slow response. However, as is seen by the teachings of Gupta et al. (Abstract; col 2, lines 50-54; col. 3, lines 16-38; col. 5, lines 30-50; col. 6, line 61-col. 7, lines 20 and 35-40; and claims 9-11, especially col. 5, lines 39-42) that for an inert plasmas gas, such as Ar, used for pre- or post-processing (deposition) plasma that prevents particle contamination of the substrate, that the inert gas may be stop simultaneous with start of the reactant gas, such that constant plasma is maintained and particle contamination prevented. While Gupta does not discuss the pressure or flow used, constant plasma is consistent with constant pressure, and whether or not gas flow between steps is constant as will depend on pumping rate or efficiency. Given the teachings of Gupta et al which are taught to be generally applicable to plasma processes, including depositions and processes exemplified by using silicon containing gases such as TEOS or for silicon oxide deposition, it therefore would have been obvious to one of ordinary skill in the art, that the dilettante gas of Kozuka (H_2 or Ar or He) need not have been mixed with the reactant gas, because it is not needed for the chemical reaction involved in the deposition and Gupta et al. shows that it is possible to achieve the objective of Kozuka (preventing contamination and achieving a full plasma before introducing reactant gas,(i.e., equivalent to no plasma on/off hysteresis) via switching from inert gas to reactant gas, instead of maintaining the inert or dilettante gas flow throughout the sequence. Kozuka's teaching of using the same pressure

would apply equally regardless of when dilettante gases are used in order to maintain plasma and particle control. Obviously, if one equipment has poor gas flow timing control, one would not use the modification form Gupta et al, but where sufficient regulation abilities exist, one would have been further motivated by saving resources from wasteful or unneed use. Furthermore, one of ordinary skill in the art would optimize their parameters in order to maintain the constant plasma or pressure as taught by the combination of references, such that depending on flow and pumping abilities of an apparatus, it would have been obvious to use the same flow for both deposition and pre-or post - deposit plasma discharges, as it would have been expected to produce constant pressure if balanced by the pumping. Furthermore, choice of particular flow rates will depend on particular apparatus configurations, chemical reaction, pumping, etc., and would have been expected to have been optimized accordingly, via routine extermination.

The timings for length of non-coating plasmas will depend on mechanical and electrical abilities of the systems, and be determined by routine experimentation by the competent practitioner. Note Kozuka discusses TFT devices in general and the presence of a gate electrode on the substrate before deposition of Si_3N_4 and ∝-Si layers on col. 7, lines 45-55.

Kozuka teaches preparation of an ∝-Si TFT on a glass substrate, where initial plasma deposition of an insulating layer of silicon nitride followed by ∝-Si deposits is taught in embodiments 2, and as mentioned above teaches maintaining plasma between deposits, of same pressure and generally discusses the important of the interface between amorphous Si and the insulating film (col. 3, lines 8-28), but does not specifically discuss silicon oxide as the insulating

film, however as SiO_2 and Si_3N_4 are conventionally uses as equivalent alternative dielectrics in semiconductor devices, it would have been obvious to one of ordinary skill in the art to substitute one for the other in the teachings of Kozuka. Note that while applicant's claim the Si deposit then the insulating film, there is no necessary order for their deposits, plus the teachings of either Kozuka or Gupta et al, make it clear that the intermediate nondeposition plasma is important regardless of the order of deposited materials.

Alternately, any of the optional tertiary references show the use of silicon oxide layers as claimed. In Kaschmitter et al., see claims 20, 22 and 24; col. 4, line 49-col. 5, line 10 and col. 7, lines 25-27. In Yamuzaki et al., see Abstract, col. 20, lines 15-49, especially 35-39 where silicon oxide and silicon nitride are taught to be equivalently used, and claims 1, 5, 7, 9 and 14. In Mei et al., see Abstract; col. 1, lines 44-49; col. 2, lines 33-66, especially lines 58-60; col. 3, lines 1-6, where SiO_2 is seen to be used before ∝-Si deposits in TFT device manufacture. Hence, use of silicon oxides as claimed, would have been an obvious alternative to Kozuka's taught silicon nitride as it has been shown to be a known equivalent alternative thereto in analogous processes and structures.

6. Claims 31-44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kozuka in view of Gupta et al. as applied to claim 23-29 and 45-118 above, and further in view of Mei et al. or Kaschmitter et al. or Yamuzaki et al.

These claims differ from the combination to Kozuka and Gupta et al in requiring that the amorphous Si containing film be crystallized using laser light, however the references of Mei et

al., Kaschmitteret al. and Yamuzaki et al. already introduced above, show that it is old and well known to use lasers to induce crystallization in ∝-Si layers in TFT structures (Abstracts, previously cited sections, plus), hence it would have been obvious to one of ordinary skill in the art to further treat the structures produced in Kozuka (as combined with Gupta et al.) as shown in any of these ternary references, because these conventional laser annealing techniques are shown to be desirable for TFT devices.

7. Czubatyj et al. was cited as equivalent to Mei et al, Kaschmitter et al., and Yamuzaki et al. for laser crystallization of ∝-Si in TFT devices, and for teachings of interest on the alternative use of $Si0_2$ or Si_2N_4 deposited by PECVD for gate insulators used in those devices.

8. Applicant's arguments filed 9/29/2000 and discussed above have been fully considered but they are not persuasive.

9. Any inquiry concerning this communication should be directed to M. L. Padgett at telephone number (703) 308-2336 on M-F from about 8 am to 4:30 pm, and FAX # 305-5408 (official) and (703) 305-6078 (unofficial).

Padgett/dh

February 9, 2001

February 15, 2001

MARIANNE PADGETT
PRIMARY EXAMINER
GROUP 1700